

## AEROLOGICAL OBSERVATIONS

[Aerological Division, D. M. LITTLE, in charge]

By L. T. SAMUELS

Free-air temperatures for November averaged lowest over Spokane and Fargo and highest over San Diego. (See table 1.) While Fort Crockett appears to average a little higher than San Diego, the former station's means are based on only six observations and are therefore unreliable. Departures from the monthly means at those stations having a sufficiently long record for establishing normals were positive, except at Pensacola and San Diego. The largest departures occurred at Omaha.

Free-air relative humidities averaged highest over

Spokane and lowest over San Diego and Kelly Field.

Free-air resultant wind directions were close to normal at practically all stations. (See table 2.) The largest deviations occurred at the western stations where greater than normal westerly components prevailed. Resultant velocities for the month were greatly in excess of the normal along the Pacific Coast and moderately below normal over the southeastern section of the country.

TABLE 1.—*Free-air temperatures and relative humidities obtained by airplanes during November 1934*

TEMPERATURE (° C.)

| Stations   | Altitude (meters) m. s. l. |                       |      |                       |       |                       |       |                       |       |                       |       |                       |       |                       |       |                       |       |                       |
|--|----------------------------|-----------------------|------|-----------------------|-------|-----------------------|-------|-----------------------|-------|-----------------------|-------|-----------------------|-------|-----------------------|-------|-----------------------|-------|-----------------------|
|  | Surface                    |                       | 500  |                       | 1,000 |                       | 1,500 |                       | 2,000 |                       | 2,500 |                       | 3,000 |                       | 4,000 |                       | 5,000 |                       |
|  | Mean                       | Departure from normal | Mean | Departure from normal | Mean  | Departure from normal | Mean  | Departure from normal | Mean  | Departure from normal | Mean  | Departure from normal | Mean  | Departure from normal | Mean  | Departure from normal | Mean  | Departure from normal |
| Billings, Mont. <sup>1</sup> (1,090 m.)                      | 2.3                        |                       |      |                       | 6.6   |                       | 5.1   |                       | 1.8   |                       | -2.0  |                       | -9.3  |                       | -16.1 |                       |       |                       |
| Boston, Mass. <sup>2</sup> (6 m.)                            | 5.5                        |                       | 5.0  |                       | 2.6   |                       | 1.6   |                       | 0.0   |                       | -1.6  |                       | -4.0  |                       | -8.9  |                       | -15.7 |                       |
| Cheyenne, Wyo. <sup>1</sup> (1,873 m.)                       | -4                         |                       |      |                       |       |                       |       |                       | 2.0   |                       | 3.0   |                       | -3    |                       | -7.0  |                       | -13.7 |                       |
| Fargo, N. Dak. <sup>1</sup> (274 m.)                         | -1.3                       |                       | .2   |                       | 1.2   |                       | 1.3   |                       | 0.0   |                       | -2.6  |                       | -5.5  |                       | -11.7 |                       | -18.3 |                       |
| Fort Crockett (Galveston), Tex. <sup>3</sup> (3 m.)          | 18.0                       |                       | 18.4 |                       | 16.6  |                       | 14.8  |                       | 13.1  |                       | 10.4  |                       | 8.0   |                       | 2.1   |                       | -4.9  |                       |
| Kelly Field (San Antonio), Tex. <sup>3</sup> (211 m.)        | 13.1                       |                       | 15.9 |                       | 15.6  |                       | 13.3  |                       | 10.9  |                       | 8.6   |                       | 6.1   |                       | -2.2  |                       | -7.1  |                       |
| Lakehurst, N. J. <sup>4</sup> (3 m.)                         | 5.5                        |                       | 6.7  |                       | 4.4   |                       | 3.2   |                       | 1.7   |                       | -7    |                       | -2.5  |                       | -8.1  |                       | -14.8 |                       |
| Maxwell Field (Montgomery), Ala. <sup>3</sup> (52 m.)        | 9.3                        |                       | 13.5 |                       | 12.3  |                       | 11.4  |                       | 9.6   |                       | 7.1   |                       | 4.9   |                       | -.6   |                       | -6.9  |                       |
| Mitchel Field (Hempstead), L. I., N. Y. <sup>3</sup> (2 m.)  | 6.2                        |                       | 6.8  |                       | 4.4   |                       | 2.3   |                       | .3    |                       | -1.8  |                       | -4.4  |                       | -11.7 |                       | -18.2 |                       |
| Murfreesboro, Tenn. <sup>1</sup> (174 m.)                    | 7.2                        |                       | 9.3  |                       | 8.8   |                       | 7.4   |                       | 5.9   |                       | 3.8   |                       | 1.3   |                       | -4.5  |                       | -10.9 |                       |
| Norfolk, Va. <sup>4</sup> (3 m.)                             | 8.6                        | 0.0                   | 9.7  | +.7                   | 7.9   | +1.0                  | 6.0   | +1.1                  | 3.9   | +1.0                  | 2.1   | +.8                   | .1    | +.5                   | -5.4  | +.3                   | -12.1 | +.3                   |
| Oklahoma City, Okla. <sup>1</sup> (391 m.)                   | 9.4                        |                       | 10.2 |                       | 11.7  |                       | 9.8   |                       | 7.3   |                       | 4.5   |                       | 2.0   |                       | -4.2  |                       | -10.9 |                       |
| Omaha, Nebr. <sup>1</sup> (300 m.)                           | 3.7                        | (6)                   | 5.5  | (6)                   | 6.7   | +3.7                  | 6.2   | +4.0                  | 4.5   | +4.1                  | 2.0   | +3.9                  | -.9   | +3.6                  | -7.0  | +3.0                  | -13.8 | +1.8                  |
| Pensacola, Fla. <sup>4</sup> (2 m.)                          | 11.5                       | -1.7                  | 13.7 | +.3                   | 12.1  | +0.1                  | 10.4  | -1                    | 8.4   | -0.5                  | 6.4   | -3                    | 3.9   | -0.6                  | -1.2  | -1                    | -7.5  | -1                    |
| San Diego, Calif. <sup>4</sup> (10 m.)                       | 12.6                       | -3.7                  | 14.9 | -1.7                  | 14.4  | -1.8                  | 12.7  | -1.2                  | 10.1  | -1.3                  | 7.8   | -1.1                  | 5.6   | -.8                   | 0.2   | 0.0                   | -6.5  | +.1                   |
| Scott Field (Belleville), Ill. <sup>3</sup> (135 m.)         | 6.0                        |                       | 8.6  |                       | 7.4   |                       | 6.3   |                       | 4.6   |                       | 2.5   |                       | 2     |                       | -5.0  |                       | -11.4 |                       |
| Seattle, Wash. <sup>4</sup> (8 m.)                           | 8.8                        | +.1                   | 8.8  | +1.9                  | 6.6   | +2.2                  | 3.0   | +1.3                  | -.2   | +.6                   | -2.8  | +.5                   | -5.6  | +.3                   | -11.3 | +.1                   | -18.3 | +.1                   |
| Selfridge Field (Mount Clemens), Mich. <sup>3</sup> (177 m.) | 4.2                        |                       | 6.1  |                       | 5.0   |                       | 2.9   |                       | .9    |                       | -1.1  |                       | -3.2  |                       | -8.5  |                       | -14.4 |                       |
| Spokane, Wash. <sup>5</sup> (596 m.)                         | 5.9                        |                       |      |                       | 6.4   |                       | 5.4   |                       | 2.8   |                       | -.3   |                       | -3.3  |                       | -9.2  |                       | -15.5 |                       |
| Sunnyvale, Calif. <sup>4</sup> (6 m.)                        | 12.2                       |                       | 12.2 |                       | 10.7  |                       | 8.4   |                       | 6.2   |                       | 3.7   |                       | 1.2   |                       | -4.6  |                       | -11.3 |                       |
| Washington, D. C. <sup>4</sup> (2 m.)                        | 6.4                        | +1.0                  | 7.2  | +1.8                  | 5.7   | +1.6                  | 3.9   | +1.4                  | 2.3   | +1.4                  | 0.6   | +1.0                  | -1.2  | +1.1                  | -5.8  | +1.4                  | -12.0 | +1.4                  |
| Wright Field (Dayton), Ohio <sup>3</sup> (244 m.)            | 5.1                        |                       | 6.5  |                       | 6.3   |                       | 4.1   |                       | 2.5   |                       | .5    |                       | -2.2  |                       | -8.5  |                       | -14.8 |                       |

## RELATIVE HUMIDITY (PERCENT)

|  |    |     |    |     |    |     |    |    |    |     |    |    |    |    |    |    |    |    |
|--|----|-----|----|-----|----|-----|----|----|----|-----|----|----|----|----|----|----|----|----|
| Billings, Mont. <sup>1</sup> (1090 m.)                       | 63 |     |    |     | 49 |     | 44 |    | 46 |     | 49 |    | 53 |    | 55 |    |    |    |
| Boston, Mass. <sup>2</sup> (6 m.)                            | 83 |     | 77 |     | 77 |     | 69 |    | 65 |     | 55 |    | 52 |    | 50 |    | 55 |    |
| Cheyenne, Wyo. <sup>1</sup> (1873 m.)                        | 59 |     |    |     |    |     |    |    | 57 |     | 48 |    | 48 |    | 47 |    | 44 |    |
| Fargo, N. Dak. <sup>1</sup> (274 m.)                         | 85 |     | 78 |     | 70 |     | 60 |    | 54 |     | 52 |    | 50 |    | 51 |    | 50 |    |
| Fort Crockett (Galveston), Tex. <sup>3</sup> (3 m.)          | 87 |     | 70 |     | 48 |     | 40 |    | 30 |     | 24 |    | 19 |    | 16 |    | 15 |    |
| Kelly Field (San Antonio), Tex. <sup>3</sup> (211 m.)        | 87 |     | 74 |     | 63 |     | 57 |    | 51 |     | 43 |    | 33 |    | 28 |    | 26 |    |
| Lakehurst, N. J. <sup>4</sup> (3 m.)                         | 89 |     | 80 |     | 78 |     | 74 |    | 68 |     | 62 |    | 55 |    | 50 |    | 41 |    |
| Maxwell Field (Montgomery), Ala. <sup>3</sup> (52 m.)        | 87 |     | 63 |     | 59 |     | 47 |    | 42 |     | 38 |    | 34 |    | 30 |    | 27 |    |
| Mitchel Field (Hempstead), L. I., N. Y. <sup>3</sup> (29 m.) | 84 |     | 73 |     | 72 |     | 68 |    | 64 |     | 55 |    | 53 |    | 49 |    | 47 |    |
| Murfreesboro, Tenn. <sup>1</sup> (174 m.)                    | 77 |     | 67 |     | 65 |     | 62 |    | 50 |     | 43 |    | 36 |    | 33 |    | 33 |    |
| Norfolk, Va. <sup>4</sup> (3 m.)                             | 76 | +1  | 68 | +3  | 64 | +3  | 53 | +1 | 54 | +1  | 49 | +3 | 42 | +4 | 34 | +3 | 31 | +3 |
| Oklahoma City, Okla. <sup>1</sup> (391 m.)                   | 76 |     | 73 |     | 63 |     | 61 |    | 58 |     | 56 |    | 49 |    | 41 |    | 41 |    |
| Omaha, Nebr. <sup>1</sup> (300 m.)                           | 86 | (6) | 79 | (6) | 70 | +12 | 59 | +6 | 54 | +4  | 51 | +2 | 51 | +1 | 51 | 0  | 48 | +1 |
| Pensacola, Fla. <sup>4</sup> (2 m.)                          | 80 | 0   | 63 | -9  | 58 | -8  | 54 | -6 | 50 | -4  | 45 | -4 | 42 | -2 | 30 | -7 | 23 | -8 |
| San Diego, Calif. <sup>4</sup> (10 m.)                       | 85 | +19 | 65 | +11 | 53 | +11 | 43 | +7 | 38 | +7  | 33 | +5 | 30 | +4 | 26 | +3 | 26 | +4 |
| Scott Field (Belleville), Ill. <sup>3</sup> (135 m.)         | 80 |     | 64 |     | 60 |     | 53 |    | 48 |     | 45 |    | 43 |    | 41 |    | 38 |    |
| Seattle, Wash. <sup>4</sup> (8 m.)                           | 85 | +5  | 77 | 0   | 74 | -1  | 76 | +6 | 74 | +11 | 63 | +7 | 54 | +4 | 47 | +5 | 43 | +5 |
| Selfridge Field (Mount Clemens), Mich. <sup>3</sup> (177 m.) | 84 |     | 71 |     | 68 |     | 67 |    | 60 |     | 53 |    | 48 |    | 43 |    | 38 |    |
| Spokane, Wash. <sup>5</sup> (596 m.)                         | 86 |     |    |     | 79 |     | 71 |    | 71 |     | 73 |    | 71 |    | 64 |    | 62 |    |
| Sunnyvale, Calif. <sup>4</sup> (8 m.)                        | 84 |     | 75 |     | 67 |     | 57 |    | 50 |     | 47 |    | 40 |    | 30 |    | 30 |    |
| Washington, D. C. <sup>4</sup> (2 m.)                        | 72 | -1  | 63 | -1  | 60 | +1  | 56 | 0  | 55 | +2  | 49 | +2 | 44 | +3 | 39 | +2 | 35 | +2 |
| Wright Field (Dayton), Ohio <sup>3</sup> (244 m.)            | 80 |     | 73 |     | 68 |     | 66 |    | 61 |     | 56 |    | 52 |    | 52 |    | 48 |    |

Observations taken about 5:00 a. m., 75th meridian time, except along the Pacific coast and Hawaii where they are taken about daylight.

<sup>1</sup> Weather Bureau.<sup>2</sup> Massachusetts Institute of Technology.<sup>3</sup> Army.<sup>4</sup> Navy.<sup>5</sup> National Guard.

\* Surface and 500-meter level departures omitted because of difference in time of day between airplane observations and those of kites upon which the normals are based.

Fort Crockett means based on only 6 observations and Seattle means on only 12 observations.

TABLE 1.—Free-air temperatures and relative humidities obtained by airplanes during October 1934—Continued

[Late reports for October 1934]

TEMPERATURE (°C.)

| Stations                                | Altitude (m) m. s. l. |                       |      |                       |       |                       |       |                       |       |                       |       |                       |       |                       |       |                       |       |                       |
|---|-----------------------|-----------------------|------|-----------------------|-------|-----------------------|-------|-----------------------|-------|-----------------------|-------|-----------------------|-------|-----------------------|-------|-----------------------|-------|-----------------------|
|   | Surface               |                       | 500  |                       | 1,000 |                       | 1,500 |                       | 2,000 |                       | 2,500 |                       | 3,000 |                       | 4,000 |                       | 5,000 |                       |
|   | Mean                  | Departure from normal | Mean | Departure from normal | Mean  | Departure from normal | Mean  | Departure from normal | Mean  | Departure from normal | Mean  | Departure from normal | Mean  | Departure from normal | Mean  | Departure from normal | Mean  | Departure from normal |
| Sunnyvale, Calif. <sup>1</sup> (6 m)--- | 14.4                  |                       | 14.0 |                       | 15.8  |                       | 14.7  |                       | 12.2  |                       | 8.9   |                       | 5.6   |                       | -1.2  |                       | -8.8  |                       |

RELATIVE HUMIDITY (PERCENT)

Sunnyvale, Calif.<sup>1</sup> (6 m.) 79 - - - - 73 - - - - 51 - - - - 38 - - - - 52 - - - - 28 - - - - 26 - - - - 23 - - - - 22 - - - -

1 Navy.

TABLE 2.—Free-air resultant winds (meters per second) based on pilot-balloon observations made near 7 a. m. (E. S. T.) during November 1933.

[Wind from N = 360°, E = 90°, etc.]